

Project Learning – Pulleys, Weights, and Rope
By Sally Mei
October 28, 2015

For the Twister attachment, we are planning on a designing a pulley system that will do the perturbation of the person sideways (left and right). Since we are designing a pulley system we are going to the basics: pulleys, weights, and rope. After looking at various types of pulleys, I came up with three options for the pulley. I found two different designs of pulleys on McMaster Carr and the third option is making a custom pulley ourselves. After I was done searching for pulleys, I looked at the weights and the rope. From what I can find online, calibrated weights are expensive. A single 5 [lb] (2.27 [kg]) weight cost about \$65 on McMaster Carr. So I decided that the best option for us is to find/buy chunks of steel (\$15 for 2x2x72 [in] bar of steel from McMaster Carr) and cut the steel into the various weight sizes needed. Last thing is the rope, and this was relatively cheap on McMaster Carr, it is only \$0.91 for 1 [ft] (30.5 [cm]). I only looked on McMaster Carr, because they have the largest selection of things, and everything that I am buy (the pulley, steel, and rope) are all relatively cheap things to buy, so it doesn't really matter where these materials are being purchased. Also, prior to looking at McMaster Carr, I went to Moscow Building Supply and Ace Hardware to see if they have any of the need material in stock. I was unable to find the right size of diameter rope, and I could find a proper pulley in these stores (all the pulley the two stores have in stock are hanging pulleys).


Pulley #1

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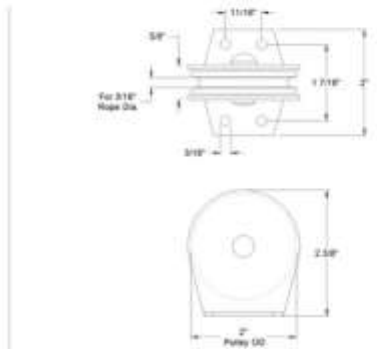
Steel Pulley for Wire Rope


Mounted Pulley, for 3/16" Rope Diameter



Part	919008
Unit Price	\$7.02 Each
Part Number	3099T34
For Rope Diameter	3/16"
Work Load Limit	600 lbs.
Mounting Hole	
Diameter	3/16"
(ID)	1 1/16"
(OD)	2"
Pulley OD	2"
Material Specifications	Steel

Warning: Never exceed work load limits. Never use for applications in which user negligence.





3D Models

View

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McMASTER-CARR **3099T34**
Mounted Pulley for Wire Rope

The information on this 3D model is provided for reference only. [Details](#)

Pros for Pulley #1

- Has a base
- Work load is 600 [lb]
- Inexpensive for a decent pulley (\$7.02)
- Has correct rope diameter (3/16")

Cons for Pulley #1

- The shaft of the pulley maybe hard to remove for the rotary encoder

Pulley #2

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Pulley for Wire Rope


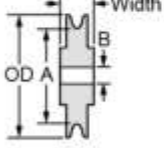
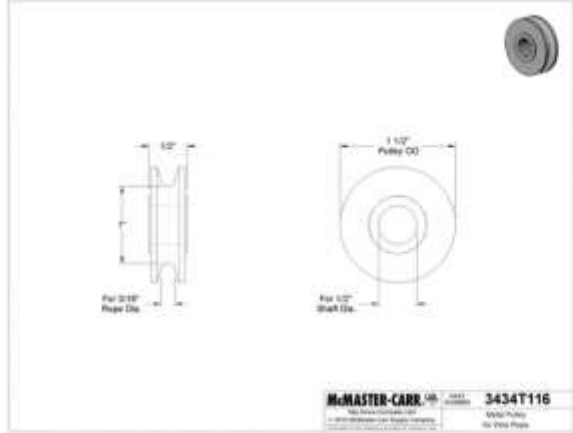
Steel, for 3/16" Rope Diameter, 1-1/2" OD

☐ Back In stock \$3.76 Each 3434T116

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For Rope Diameter	3/16"
OD	1-1/2"
Work Load Limit	525 lbs
Groove Diameter (in)	1"
For Shaft Diameter (in)	0.5"
Width	1.2"
Additional Specifications	Steel

Warning! Never secured with load (unless Never use to lift people or items over people)

McMASTER-CARR 3434T116

1/2" Groove Diameter
1-1/2" Pulley OD
For 3/16" Rope Diameter
For 1/2" Shaft Diameter

[3-D Exploded View](#) [Save](#) [Print](#)

The information in this 3-D model is provided for reference only. Details

Pros for Pulley #2

- Work load is 525 [lb]
- Cheaper than Pulley #1 (\$3.76)
- Has correct rope diameter (3/16")

Cons for Pulley #2

- Doesn't have a base
- The hole maybe too big for the rotary encoder shaft

Weights

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calibrated weights **OF** FIND CONTACT US BOOKMARKS ORDER HISTORY

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Calibration Weights


Additional Weights

16 Products

Interlocking Test Weights

Stack multiple weights to calibrate your scales—they are grooved to fit together. Weights are cast iron and are marked with their weight. They have a 6-16" wide slot for use with a hanger (sold separately) to test hanging scales. Weights meet ANSI/ASTM Class 0 tolerances and include a statement of accuracy.

Weights

✓  Weights (Shown with Optional Hanger)

Weight English	Tolerance	Dia.	Ht.	Each
1/2 lbs.	±0.0001 lbs.	3 3/4"	5/16"	1850T11 \$38.24
1 lbs.	±0.00015 lbs.	5"	5/16"	1850T12 41.21
2 lbs.	±0.0002 lbs.	5"	5/16"	1850T13 47.06
5 lbs.	±0.0005 lbs.	5"	1 1/8"	1850T14 66.67
10 lbs.	±0.001 lbs.	6"	1 1/2"	1850T15 83.33
20 lbs.	±0.002 lbs.	8"	1 7/8"	1850T16 113.33
50 lbs.	±0.005 lbs.	10 1/4"	2 3/4"	1850T17 210.64
Metric				
500 g	±0.05 g	5"	5/16"	1850T22 42.42
1 kg	±0.0001 kg	5"	5/16"	1850T23 55.88
2 kg	±0.0002 kg	5"	1"	1850T24 60.61
5 kg	±0.0005 kg	6"	1 1/16"	1850T25 97.30
10 kg	±0.001 kg	8"	1 15/16"	1850T26 131.58
20 kg	±0.002 kg	10 1/4"	2 3/8"	1850T27 233.33

Optional Hangers for English Weights

Capacity, lbs.	Dia.	Ht.	Hanger Wt., lbs.	Each
200	3 3/4"	9 1/4"	1	1850T41 \$76.47
200	3 3/4"	20 1/4"	1	1850T42 85.29

Optional Hanger for Metric Weights

Capacity, kg	Dia.	Ht.	Hanger Wt., kg	Each
75	3 3/4"	9 1/4"	1	1850T51 \$120.59

Calibrated weights as stated before are expensive. Whereas buying a bar of steel is very cheap.

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Low-Carbon Steel Rectangular Bar

1/8" Thick, 2" Width

 Length ☒ 8 ft. ☐ Each **ADD TO ORDER**

In stock
\$15.00 Each
8010K399

Grade	1015
Shape	Rectangular Bar
Finish	Unpolished
Thickness	1/8"
Thickness Tolerance	-0.006"
Width	2"
Width Tolerance	-0.005"
Yield Strength	54,000 psi
Hardness	Medium (Rockwell B70)
Specification Met	ASTM A108
Construction	Cold Drawn
Material Composition	
Carbon	0.13-0.20%
Manganese	0.30-0.90%
Silicon	0.15-0.30%
Phosphorus	0.04% Max.
Sulfur	0.50% Max.
Iron	96.06-99.42%
Nominal Density	0.283 lbs./cu. in.
Electrical Resistivity	15.9 microhm-cm @ 32° F
Thermal Conductivity	29.4 Btu/in. ft. °F @ 212° F
Coefficient of Thermal Expansion (Test)	6.7-7.5 × 10 ⁻⁶
Elongation Range	10-36%

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Rope

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Vinyl Coated Wire Rope - Not for Lifting

Stainless Steel, Ultra-Flexible 7x19, 3/16" Diameter, 350 lb. Capacity



Color

- ☐ Black
- ☐ Clear
- ☐ Orange
- ☐ Red
- ☐ Yellow

Length, ft.

10	100
25	300
50	Other

☐ Each

ADD TO ORDER

\$0.91 per ft.
8912T71

Material	Stainless Steel
Coating	Vinyl Coated
Construction	7 x 19
Rope Diameter	
Coated	0.188"
Bare	1/8"
Load Capacity	350 lbs.
Fits Pulley/Drum Diameter	4 7/8"
Temperature Range	-30° F to 180° F
Additional Specifications	Wire Rope Selection Criteria
RoHS	Compliant

The plastic coating protects this wire rope from abrasion and your drums and pulleys from wear. The wire rope is 18-8 stainless steel for excellent corrosion resistance. Rope is preformed to prevent it from unraveling when cut. It is lubricated.

Vinyl Coated—Vinyl has better UV resistance than nylon.

Note: When attaching fittings to coated rope, the coating must be removed from the installation area. Load capacity has a 5:1 safety factor compared to breaking strength.

Rope is very cheap, and it can hold 350 [lb] (159[kg]), and it has a rope diameter of 3/16" which isn't too big or too small, which makes it perfect for this pulley system.